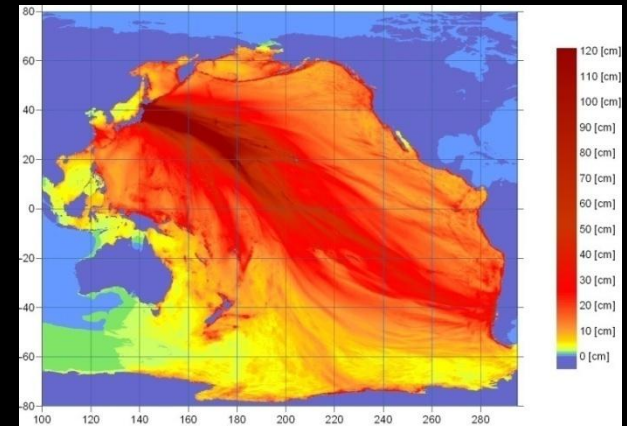


James D. Goltz Ph.D.
Branch Chief (Retired)
Earthquake, Tsunami and Volcanic Hazards Program
California Emergency Management Agency
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Ultimate Vulnerability: Death and Injury in Tsunamis



Some Observations from 3-11-11

- Per National Police Agency of Japan (July 18, 2012):
 - Deaths: 15,867
 - Missing: 2,906
 - Injuries: 6,109
- Three prefectures accounted for 99.6% of fatalities
 - Miyagi: 9,524
 - Iwate: 4,671
 - Fukushima: 1,606
- Miyagi Prefecture had 68% of the injuries
- Tsunami caused 92% of all fatalities

What factors lead to death and Injury in tsunamis?

- **Being in the inundation zone:**
 - Correlation between maximum run-up height and fatality .72
 - Correlation between housing damage (comp. destroyed) and fatality .92
 - Distance between where in zone one was located and safety
- **Advanced age and mobility impairments**
 - 65% of the fatalities were 60 years or older
 - Demographic trends in region resulted in an older population
- **Warning time and response to warnings**
 - Arrival time of tsunami inundation varied from 30 min to 3 hrs
 - First warning of tsunami was approx 3 minutes after the earthquake
 - Evacuation behavior varied, delays due to many factors including underestimate of risk, desire to assist others, tendency to normalize situation
- **Magnitude of the event/mitigation failures**
 - 1000 year event
 - Over-reliance on sea walls, vertical evacuation and early warning system

What was the cause of death and what types of injuries?

- Drowning accounted for 92.5% of fatalities
- But contributing factors (e.g. trauma) not well known/documentated
- Injuries included hypothermia, water inhalation, broken bones, cuts and abrasions, exacerbated medical conditions due to lack of medication
- Not clear whether injuries, in ambiguous cases, were from earthquake or tsunami.

Public health issues after the tsunami

- Deaths and injuries are not the total story
- Public health issues in the evacuation centers:
 - Hypertension
 - Deep Vein Thrombosis
 - Respiratory problems
 - Mental and Psychosocial health
 - Infectious diseases
- The many earthquakes experienced by Japan has resulted in well prepared medical response capability-none of the above conditions became severe.

Some research needs and opportunities

- Only a small subset of data collected by Japanese authorities on fatalities are available for research
- More detailed studies are now becoming available
- Injury/fatality ratio between earthquake and tsunami requires further investigation
- NIBS is supervising the development of a HAZUS model for tsunami in US

Data Available vs. Data Collected

DATA AVAILABLE

- Name
- Gender
- Age
- Community of Residence

DATA COLLECTED

- Name
- Gender
- Age
- Date of Birth
- Date body recovered
- Location of body
- Date/confirmation of death
- Situation of death (e.g. who found body? In car? In building? In open?)
- Address (at TOD)

Convalescent Facility: Sendai



Interior View



Exterior View



Questions?

Discussion?